NETWORKS AND CRYPTOGRAPHY — PROBLEM SET 1

DUE FRIDAY, FEB-13, AT 9:00 AM

Note that these questions are from the text. I present them here just in case you have not yet acquired a copy, which you should do right away.

1. **Chapter 1, question 1:** Imagine that you have trained your St. Bernard, Bernie, to carry a box of three 8 mm tapes instead of a flash of brandy. (When your disk fills up, you consider that an emergency.) These tapes each contain 7 GB. The dog can travel to your side, wherever you may be, at $18\ \frac{km}{hour}$. For what range of distances does bernie have a higher data rate than a transmission line whose data rate (excluding overhead) is $150\ \frac{Mb}{sec}$.

2. **Chapter 2, question 2:** A noiseless $4-kHz$ channel is sampled every $1\,msec$. What is the maximum data rate?

3. **Chapter 2, question 3:** Television channels are $6\,MHz$ wide. How many $\frac{bits}{sec}$ can be sent if four-level digital signals are used? Assume a noiseless channel.

4. **Chapter 2, question 4:** If a binary signal is sent over a $3-kHz$ channel whose signal-to-noise ratio is $20\,dB$, what is the maximum achievable data rate?

5. **Chapter 2, question 9:** Is the Nyquist theorem true for optical fiber or only for copper wire? Why?

6. **Chapter 2, question 22:** *[This question relies on a figure in the book, so you must obtain a copy of the text to answer it.]*

7. **Chapter 2, question 28:** Ten signals, each requiring $4000\ Hz$, are multiplexed on to a single channel using FDM. How much minimum bandwidth is required for the multiplexed channel? Assume that the guard bands are $400\ Hz$ wide. *[Note: A* guard band *is an excess portion of the frequency range used to buffer one FDM channel from another, thus reducing frequency. See Section 2.5.4 in the book for a more complete explanation and example.]*